

# **Long-term Ramifications of the Landsat 7 Failure: Alternative Funding Strategies**

**A report to the  
House Appropriations Committee,  
Subcommittee on Interior and Related  
Agencies**

**October 15, 2003**

## **Long-term Ramifications of the Landsat 7 Failure: Alternative Funding Strategies**

### **BACKGROUND**

The Land Remote Sensing Policy Act of 1992 (P.L. 102-555) directs the Secretary of the Interior to “provide for long-term storage, maintenance, and upgrading of a basic, global land remote sensing data set” and to “assure ... timely access for parties requesting data.” Further, such data are to be “made available to all users without preference, bias or any other special arrangement [except national security] regarding delivery, format, pricing, or technical considerations which would favor one customer or class of customers over another.” This Act also established a Landsat Program Management team to oversee the operational Landsat 4 and Landsat 5 missions, develop and operate the Landsat 7 mission, establish cooperation with the international community, and assess options for a successor system to Landsat 7. The over-arching purpose of the program is to provide remote sensing data for use in applications and scientific investigations conducted by a global community of government, academic, and commercial users.

Presidential Decision Directive NSTC-3 (signed May, 1994 and revised October 16, 2000) states “The Department of the Interior/USGS will assume responsibility for management and operations of the Landsat 7 ground system elements at the USGS EROS Data Center and the Landsat 7 Program Management Office and its oversight functions” and “continue to maintain a national archive of existing and future Landsat-type remote sensing data within the United States and make such data available to the U.S. Government and other users.”

The DOI and the USGS have been involved in the Landsat program since 1966, under the Secretary of the Interior Stewart Udall. During the Earth Observation Summit held in Washington, D.C. on July 31, 2003, Secretary of the Interior Gale A. Norton stated that, “For more than 30 years, the Landsat system, now managed by our Geological Survey, has been the only source for an extended record of moderate-resolution space-based observations of the landmass of our planet.”

Landsat 7 provides unique data for a variety of scientific and commercial activities. Within the DOI, Landsat 7 is an operational tool for such things as detecting and monitoring invasive plant species in remote regions (USGS Biological Resource Programs and DOI Bureau of Land Management), assessing water volume in snow pack and large Western aquifers (USGS Water Resources Programs and DOI Bureau of Reclamation), assessing the stewardship of Federal grazing lands (Bureau of Land Management), and monitoring land use/land change in remote regions (DOI Bureau of Indian Affairs). However, the major U.S. users of Landsat 7 data are the U.S. Department of Agriculture, for global crop monitoring, and the National Imagery and Mapping Agency, for global mapping. Other major users are international government agencies concerned with natural resources, agricultural production, and land use/land change.

One impact from the lack of Landsat 7 data during the 2003 fire season was a significant decrease in the ability of the USGS to provide timely wildfire burn mapping information to DOI and other U.S. data users. The 8-day coverage cycle of Landsats 5 and 7 is critical for monitoring potential fire conditions and, as clearly demonstrated during the Hayman, Colorado fire last year, is very important for tracking the spread of fires. Secondly, the thermal infrared band is useful in monitoring fire expansion.

The USGS responsibilities within the Landsat Program are to: (1) operate the satellites, (2) capture, process, calibrate/validate and archive<sup>1</sup> the data, and (3) provide access to, derive, and distribute products – at the cost of fulfilling a user request (COFUR). The USGS operating budget for the Landsat Program is about \$21.2 million per year. Approximately \$10.2 million of that amount is from appropriated funds, and \$11 million is derived from data product sales and cost-share fees from International Cooperators (hereinafter called sales/IC revenue).

The appropriated funds are used to support program administration and satellite flight operations (#1 above). The sales/IC revenue covers the remaining operational expenses (#2 and #3 above) that include: capturing data intended for the U.S. archive; processing, archiving, and providing on-line access to the captured data; data product derivation and distribution, including customer service, billing, and accounting; data calibration and validation; and coordination and management of the international network of 17 ground stations. For FY04 and beyond, as a result of the scan-line corrector failure and the loss of a reliable revenue source, the USGS is faced with having only \$10.2 million of appropriated funds that can be counted upon for managing flight and basic support of operations of the Landsat 5 and Landsat 7 missions. The \$11 million in sales/IC revenue is now an uncertain funding source for the future.

### **SALES/IC REVENUE IMPACTS**

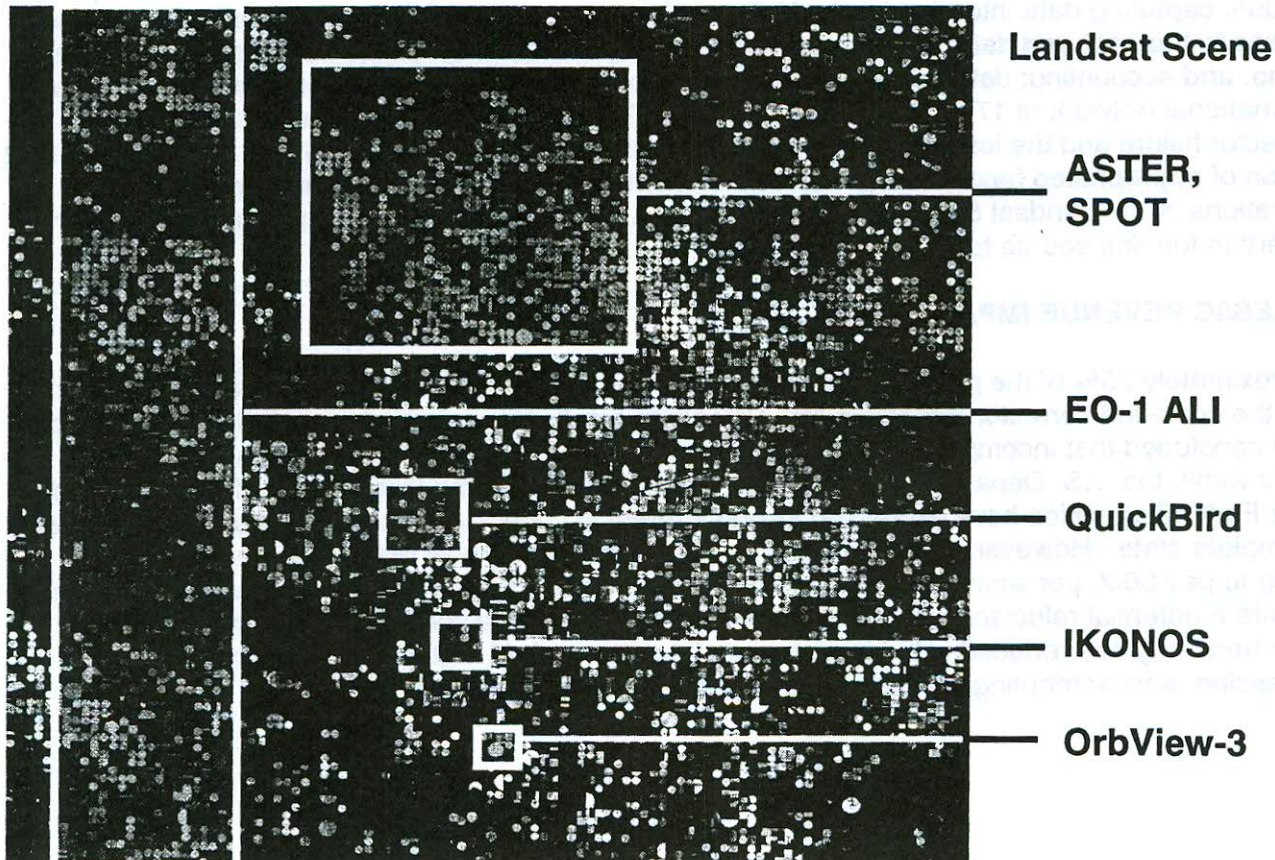
Approximately 75% of the picture elements, or pixels, in each new Landsat 7 scene will be intact with the scan-line corrector remaining off. Scientists conducting a preliminary study (see Appendix) have concluded that incomplete Landsat 7 scenes are still highly useful for many applications. Users within the U.S. Department of Agriculture (see Appendix), the Department of Defense, and other Federal agencies have expressed strong interest in continuing to use Landsat 7 scenes in an incomplete state. However, the USGS has no way of predicting how many users would still be willing to pay \$600 per scene for this degraded data. Unsolicited comments received from users indicate a potential reluctance to paying full prices for incomplete scenes. Unfortunately, while customers may see reduced value in an incomplete scene, the USGS costs for extracting, processing, and distributing the data have not gone down.

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<sup>1</sup>Landsat 7 data are currently archived within the stand-alone Landsat 7 ground data processing system. When the mission ends, these data will be transferred to the USGS National Satellite Land Remote Sensing Data Archive (NSLRSDA) that holds data from several other satellite missions, including declassified data as well as data from previous Landsat satellites. NSLRSDA funding does not contribute to operation of the Landsat Program.

## Landsat 7 is a Unique Asset

Although there are several other Earth observation systems on orbit, Landsat 7 provides a unique set of capabilities. The combination of moderate resolution (30-meter), broad-area coverage, spectral range, and global availability cannot be duplicated by other existing satellite systems. Landsat 7 collects over 90,000 scenes a year of the Earth's landmasses (see Appendix). The standard scene areas of some of the instruments that have been considered as possible substitutes for Landsat 7 are shown in Figure B-1 below.



**Figure B-1.** Compares the scene area coverage from other satellite systems to a standard Landsat image.

The costs that would be incurred to utilize other satellite systems to substitute for Landsat 7 would be prohibitive—if they were even available. Each system has a different swath width, a different revisit rate and time, and a significantly different resolution, as demonstrated in the above figure. In order to cover the area of a scene taken from Landsat 7, it would require 9 scenes from either the ASTER and SPOT systems, with costs ranging from \$540 to \$36,450 for the equivalent quantity of Landsat data. For higher resolution satellites such as IKONOS, the costs are even higher, needing 283 scenes at about \$567 per scene to cover the Landsat 7 scene. It would also take several revisits from any of these systems to acquire the equivalent of a Landsat 7 scene. These revisit times could take from several weeks to months and would be hampered by cloud cover conditions.

## MANAGEMENT CONSIDERATIONS

The USGS Land Remote Sensing Program has been delegated the responsibility to ensure full compliance with the Department of the Interior's obligations under pertinent laws, regulations, and policies governing the Landsat Program. To meet this agency obligation, the USGS must ensure continued operation of the two satellites, must archive and maintain all data acquired by those satellites, and must ensure that all customers have access to products available from the data. In order to meet these obligations the USGS is proposing the following:

- **Resume sale of Landsat data, supplemented by a temporary reprogramming of \$3.5 million.** The USGS is currently unable to accurately assess the sales/IC revenues that could be generated from distributing degraded Landsat 7 data. A number of customers have expressed interest in that data, but there is substantial uncertainty as to whether they will resume purchases at pre-failure levels. One guess is that revenue may reach only \$3.0 million, less than one-third of pre-failure revenue. However, USGS believes that the only reliable test of market interest will be to resume sale of data. USGS proposes to restart sales on November 1. Initial costs can be borne from appropriated funds, but it will be necessary to submit a temporary reprogramming of \$3.5 million. During the first quarter of FY 2004, the USGS would continue to track data sales and monitor customer use of and satisfaction with degraded Landsat 7 data, enabling a more accurate projection of sales revenue for the remainder of the year. If sales do not reach levels that can support program operation, it will be necessary to examine other options, including program shut-down. For example, if sales reach only the \$3.0 million level, the program would be \$4.5 million short of 2004 funding needs, even taking into account the \$3.5 million reprogramming.

An increased demand placed on Landsat 5 since the Landsat 7 instrument malfunction has triggered problems with Landsat 5's ability to transmit data to the ground. Engineers are concerned that further demands on Landsat 5 could render it incapable of capturing the data it currently provides. Therefore, this proposal does not contain any option that would include additional tasking of Landsat 5.

# Comparisons Report

## Landsat 7 Sales Fiscal Year Comparison

